

Proposed Guidelines for Internal Rules for Radiation Safety

These rules are instructions for the management
of patients to be given or containing radioactive materials.

These rules are also for the ordering,
handling and disposal of radioactive materials and sources.

Contributors:
Mr OR van Reenen
Dr AC Chamberlain

Produced by the South African Radiation Protection Society

Preamble

This document is intended to serve as a guideline for hospitals/practices, which currently do not have a set of internal rules, to use in drawing up their own rules. It is recognised that many hospitals/practices already have a comprehensive set of internal rules adapted to their own needs and conditions. It is not intended that these rules should replace them. Rather hospitals/practices who do not currently have a set of rules should take these guidelines and adapt them to their own situation.

These guidelines have been drawn from a number of sources and the contributors wish to acknowledge the Department of Medical Physics at Orange Free State University and the Department of Medical Physics at the Medical University of Southern Africa.

Contents

1.	Handling of ¹³¹I - Therapeutic administrations to patients	3
1.1	¹³¹ I –Capsules High dose >1110 MBq (30mCi) - Ablation of thyroid	3
	▪ Administration	3
	▪ Patient Care	3
	▪ Discharge of the patient	3
	□ Information for the patient	4
	□ Information for nursing personnel	4
1.2	¹³¹I Capsules - Doses up to 370 MBq (10 mCi) for Thyrotoxicosis	6
	▪ Administration	6
	▪ For hospital patients, the following additional regulations apply	6
	□ Information for the patient	7
	□ Information for nursing personnel	7
2.	HANDLING OF ¹⁸⁶Re THERAPEUTIC ADMINISTRATIONS	8
	▪ Administration and patient care	8
	▪ Discharge of the patient	8
	□ Information for the patient	8
	□ Information for nursing personnel	9
3.	Table 1: Recommendation regarding breastfeeding mothers	10
4.	Table 2: Recommended activities for authorizing a patient’s release	11
5.	Radiotherapy	
	▪ Handling of UNSEALED radionuclides	12
	• ¹³¹ I - MIBG	
	• ³² P	
	▪ Handling of SEALED radionuclides	12
	• ⁹² Ir - Wire	
	• ¹⁹⁸ Au - Gold seeds	
	• ⁹⁰ Sr- Eye applicators	

1 HANDLING OF ¹³¹I THERAPEUTIC ADMINISTRATIONS

1.1 ¹³¹I Capsules more than 1110 MBq (30mCi) - Ablation of the thyroid

1. The Medical Doctor must ensure that the patient is not pregnant before the capsule is prescribed by completing Section 1 of Annexure-A.
(NB the ¹³¹I will not be ordered if Annexure-A Section-1 is not completed)
2. The Medical Physicist, responsible for the administration of the ¹³¹I, will order the activity through the Dept Medical Physics by completing Section 2 of Annexure-A.
3. On arrival of the ¹³¹I, the activity is to be checked to have the correct activity on the day of administration. Place the activity in the vault.
4. On the day of administration, the ¹³¹I activity is measured and recorded by the medical physicists on Annexure-A Section 3.
5. The capsule is taken by the medical physicists to the ward.
[NB Remember to take along the radiation monitors to be worn by the nursing staff]

Administration:

1. Patient must be kept isolated in a private room with appropriate Radioactivity warning signs.
2. Confirm the patient's identity and, in the case of a female patient make sure that she is not pregnant. Check if the patient has false teeth. Patient has to remove dentures if any. NB. Before administering the capsule make sure that you get the confirmation from the doctor in charge.
3. Wear plastic gloves and roll the capsule(s) into a small disposable container.
4. Give clear instructions to the patient that the capsule must not be chewed but swallowed whole with the supplied water.
5. Roll the capsule into the patient's mouth and supply sufficient water to swallow the capsule.
6. Inform the patient of the precautionary regulations. *(Documents to be drawn up in local languages)*
7. Complete section 4 of Annexure-A. and staple in the patient's file.
NB Prescribing doctor AND Medical Physicist must sign this form.
8. Inform the nursing staff of the precautionary regulations and ensure that no pregnant or maybe pregnant staff attends to this patient.
9. Note the initial readings on radiation monitors to be worn by the nursing staff while caring for the patient. *(A document should accompany the radiation monitors where a permanent record of the wearers is recorded)*

Patient care:

1. Patient must be kept isolated in a room with appropriate Radioactivity warning signs.
2. Patient must flush toilet twice after use and wash hands thoroughly before returning to the isolation room.
3. Monitor the patient at regular intervals until radiation level is less than 6 µSv/h (2,5 mR/h) at a distance of 1m, then the patient may be discharged. Annexure-B must be completed for each measurement made.

Discharge of the patient:

1. The patient may only be discharged once a medical physicist has determined that the dose rate at 1m from the patient is below 6 µSv/h (2,5 mR/h) [Complete and sign Annexure-B].
2. After patient has left the isolation room, the room, linen and refuse must be monitored by the responsible medical physicist. If contaminated they have to be stored in a separated room until the activity has dropped to an acceptable level i.e. below 6 µSv/h (2,5 mR/h).
3. Remove the Radioactivity warning signs from the patient's door.

4. Collect the radiation monitors that were worn by the nursing staff while caring for the patient. Record the readings on the radiation monitors in the accompanying document.

Information for the patient -Ablation of the thyroid

Your illness is treated by administering a radioactive iodine capsule. The iodine concentrates in the thyroid and then irradiates the thyroid thereby destroying the thyroid. Some of the radioactive iodine is excreted by the kidneys in the urine as well as through perspiration and saliva. Certain precautions are taken to prevent the radioactivity from contaminating and irradiating other persons unnecessarily.

Guidelines:

1. You will be admitted to a private room. You can only use a shower and toilets allocated for your use by the nursing personnel. No other person is allowed to use these facilities until they were monitored by the medical physicist who will declare these facilities safe for all users. You are requested to flush the toilet twice after use and regularly wash your hands thoroughly.
2. For the protection of others, you may only leave the room to go to the toilet or shower. The responsible medical physicist will monitor your radiation level regularly and will give you permission to go home as soon as your radiation level is low enough.
3. For their own safety, visitors are not allowed within 2 (two) meters from your bed.
Children and pregnant women may not visit you at all.
4. Within a period of 6 (six) months after administration of the radioactive iodine, female patients are recommended not to fall pregnant.
5. The possibility exists that personal items e.g. clothing, radio, books, etc., as well as snacks you may have received during your stay, may get contaminated. These items will be monitored when you are discharged and if necessary kept until radiation levels have decreased to safe levels.

(This document must be made available in all local languages)

Information for nursing personnel- Ablation of the thyroid

From time to time patients who have received a therapeutic dose of a radionuclide e.g. Iodine-131 are admitted to the wards. The radionuclide is excreted in urine and is of utmost importance to closely monitor anything that becomes contaminated with urine. It is important to note the following:

1. Bathroom and toilet facilities

- a) The patient must be admitted to a private room with a toilet and bathroom in the same suite for their exclusive use. Ensure the radioactive warnings are clearly visible on the doors of the patient's room (and outside toilet if applicable).
- b) If the patient is forced to use a bathroom/toilet outside his/her room, a nurse must always accompany the patient to bathroom/toilet to make sure that the patient uses the facilities, which have been designated for their exclusive use.
- c) Instruct the patient to flush the toilet at least twice after use and to wash their hands thoroughly.

2. Linen and cutlery

- a) Make sure that the mattress of the patient's bed is covered with a non-absorbent material like plastic.
- b) When linen is changed, the dirty linen must be kept in the room in a plastic bag until the medical physicist has checked it for contamination.
- c) Because of the danger of contamination with iodine the patient must be supplied with disposable cutlery. If not the cutlery must be placed in the room until the patient is discharged.

- d) All articles used or handled by the patient, such as patient's clothing and towels, should preferably be handled with gloves and the handling should be kept to a minimum.

3. Waste disposal

- a) Provide the patient with two bins, each lined with a plastic bag.
- b) Ask the patient to use the bin for the dirty linen/clothing and for general waste such as food.
- c) **No articles, including waste bags, may to be removed from the room until a medical physicist has checked them for radioactive contamination.**

4. Personal dosimeters

- a) Nursing personnel who attend to the patient must wear a direct-reading dosimeter.
- b) At the end of each day the dosimeter reading must be noted in a book which must be available for inspection purposes.
- c) Thereafter the medical physicists must record the reading.

5. Attending to the patient

Normal nursing duties should continue but the following points should be kept in mind:

- a) The amount of time spent by the nursing staff in the vicinity of the patient should be limited to the necessary minimum, particularly during the first two days.
- b) To minimise the risk of radiation, nursing personnel should keep a distance as large as practically possible between themselves and the patient when attending to his/her needs.

6. Pregnant nursing staff

Pregnant nursing personnel should not be involved with the care of the patient, but may however still continue with their duties in the ward as long as care is taken not to spend time in the vicinity of the room.

7. Other patients and visitors

- a) The patient must always be escorted when he/she leaves the room.
- b) Nursing staff must ensure that other patients or visitors do not have unnecessary close contact with the patient for prolonged time periods.
- c) Instruct visitors to the patient not to remain at a distance closer than 2m from the patient, especially if there is young children in the visiting room. Pregnant women should not come closer to the patient than the doorway and then for a couple of minutes.
- d) If applicable, inform the other patients in the ward that the use of the designated toilet is forbidden.
- e) Take care that patients who are waiting treatment or examination do not queue up and wait in close vicinity of the door of this room.

8. Discharge of the patient

The patient may only be discharged once a medical physicist has determined that the dose rate at 1 meter from the patient is below $6\mu\text{Sv/hr}$ (2.5 mR/hr).

9. Radiation emergencies

In case of any incident causing a radiation hazard, please contact the Medical Physicist responsible. His/her name and telephone number is on the Radioactivity Sign outside the patient's room.

- IF the responsible Medical Physicist cannot be contacted phone the department of Medical Physics at 521 4390.
- IF the Department is not available phone Prof WJ Strydom at 082 885 0042.

1.2 **¹³¹I –Capsules up to 370 MBq (10mCi) for Thyrotoxicosis**

The Medical Doctor must ensure that the patient is not pregnant before the ¹³¹I capsule with an activity less than **370 MBq** (<10 mCi) is prescribed. The ¹³¹I capsules are ordered through the normal channels by the Dept Medical Physics.

Administration:

1. On arrival of the ¹³¹I, the activity is to be checked to have the correct activity on the day of intended administration. Place the activity in the vault.
2. On the day of administration, the responsible Medical Physicist must ensure that the ¹³¹I activity is as prescribed.
3. Confirm the patient's identity; in the case of a female patient ensure she is not pregnant. Check if the patient has false teeth. Patient has to remove dentures if any.
NB. Before administering the capsule, make sure that you get the confirmation from the Doctor in charge. The activity of the capsule must be recorded in the patient's file by the prescribing Medical Doctor.
4. Wear plastic gloves and roll/slide the capsule(s) into a convenient disposable container.
5. Give clear instructions to the patient that the capsule must not be chewed but swallowed whole with the supplied water.
6. Roll the capsule into the patient's mouth and supply sufficient water to swallow the capsule.
7. Inform the patient of the precautionary regulations.

For hospital patients, the following additional regulations apply

1. The Medical Physicist responsible for the administration of the ¹³¹I has to accompany the patient to the ward and explain the precautionary regulations to the personnel.
2. The patient is measured after administration of the ¹³¹I to ensure that the radiation level is less than 6 µSv/h (2,5 mR/h) at 1 meter.
3. If the radiation level of the patient is higher than 6 µSv/h (2,5 mR/h) at a distance of 1meter, the nursing personnel has to be informed to keep all a distance of 1m from the patient and to minimise the time spent with the patient. This must be enforced strictly for the first two days after administration.

Information for the patient –Thyrotoxicosis treated with ¹³¹I

Your illness is treated by administering radioactive iodine in a capsule form. The iodine concentrates in and irradiates your thyroid. During the first four days following administration, the majority of radioactive iodine-131 is however excreted by the kidneys in the urine as well as through perspiration and saliva. Therefore certain precautions are taken to prevent the radioactivity from spreading to and irradiating other persons unnecessarily.

Guidelines

1. Flush the toilet twice after use and wash hands very well regularly.
2. Avoid contact with children and pregnant women during the first two days after administration; this implies that you should not come less than 1 meter from such persons for longer than it takes to shake hands.
3. Do not kiss anybody and couples could preferably sleep in separate beds (spaced at least 1 meter apart) for at least 14 days after administration.
4. Within a period of 6 months after administration of the radioactive iodine, female patients may not fall pregnant.
5. Avoid contact with infants and pregnant women.
6. Do not use mass transport (taxi, bus, boat, plane etc).

(This document must be made available in all local languages)

Information for nursing personnel-Thyrotoxicosis

From time to time patients who have received a therapeutic dose of a radionuclide e.g. iodine-131 are admitted to the wards. Iodine is an unsealed radiation source that could lead to contamination. The radioactivity is excreted in urine and it is of the utmost importance to closely monitor anything that becomes contaminated with urine. When nursing these patients every possible precaution must be taken to limit exposure to personnel. It is important to take note of the following:

1. Ensure that radioactive warnings signs are clearly visible on the file and above the patient's bed during the first two days after administration.
2. Bring it to the patient's attention that the toilet has to be flushed twice after use. Should the patient be catheterised, great care has to be taken to prevent contamination. Collected urine may not be sent to laboratories. Use gloves to handle the urine bag and empty in the toilet after disconnected from the patient. Wash hands thoroughly (twice) after this procedure.
3. During the first two days after administration of the radionuclides, babies and pregnant women, have to maintain a distance of at least 1 meter from the patient.

Should the patient be very ill and require extensive nursing, the medical physicists must be notified. The physicists will prescribe special precautionary measures if necessary.

2 HANDLING OF ^{186}Re THERAPEUTIC ADMINISTRATIONS

Administration and patient care

1. The patient has to preferably be hospitalised in a private room and if this is not possible, in a corner, a small distance removed from the other patients in the wards.
2. Sufficient care has to be taken not to spill any of the radionuclide during intravenous administration.
3. The patient has to be encouraged to drink a lot of water, to assist the kidneys in excreting the activity that has not been absorbed.
4. Should the patient have a bladder catheter, the urine bag must be shielded with lead while imaging and when the patient is in the ward.
5. If nightclothes and bedding are contaminated with urine, it must be placed in plastic bags and monitored by a physicist, before taking it to laundry.
6. Urine has to be carefully collected in clearly labelled plastic bottles, which are supplied, and hands washed thoroughly. Should any urine spill, it must be cleaned immediately, accordingly be collected in plastic bottles.
7. Collected urine has to be removed regularly by the responsible person at Medical Physics and stored at Nuclear Medicine.

Discharge of the patient

Discharged patients have to be

- a. measured by a Medical Physicists to monitor the exposure.
- b. informed that they have to report for follow-up tests on given dates and to complete the pain monitoring forms regularly.

Information for the patient – Rhenium palliative treated

Patient information

Your illness is treated by administering radioactive rhenium intravenously. This treatment is only **aimed at pain relief** and **does not cure the illness**. The rhenium concentrates in the bone lesions and radiates them, in order to bring down the pain. Some of the radioactive rhenium is however excreted by the kidneys into the urine. Certain precautions have to be taken to protect other persons from radiation and prevent contamination of the environment.

Guidelines:

1. As far as possible attend to your personal needs yourself during the first day after administration.
2. Avoid contact with children and pregnant women during the first three days after administration- this implies that you should not come less than one (1) meter from such a person for longer than it takes to shake hands.
3. Flush the toilet twice after use and wash hands thoroughly.

Information for nursing personnel - Rhenium patients

From time to time patients receive palliative treatment by administering a therapeutic dose of the radionuclide Re-186. Re-186 is an unsealed source which mainly decays with a soft beta ray and has a relative short half-life of 89.3 hours. It is excreted in urine that could lead to contamination.

Contamination with urine must be closely monitored.

1. The patient has to be preferably hospitalised in a private room, otherwise in a corner a small distance removed from other patients in the ward.
2. Bring it to the patient's attention that the toilet has to be flushed twice after use. Should the patient be catheterised, great care has to be taken to prevent contamination. Wash hands thoroughly.
3. Should contamination of nightclothes and bedding occur, it has to be placed in a plastic bag and the medical physicists asked to come and remove it.
4. During the first three days after administration of the radionuclide, babies and pregnant women, have to maintain a distance of at least 1 (one) meter from the patient.
5. Before patients are discharged, the physicist has to monitor the exposure rate of the patient and the bedding.

Should the patient be very ill and require extensive nursing or you need any additional information; the medical physicists must be notified. The medical physicist will prescribe special precautionary measures if necessary.

Recommendations and rules regarding breastfeeding mothers

1. The referring physician may delay the investigation or consider a different investigation (ultrasound, MR, different radiopharmaceuticals) which gives less radiation to the infant.
2. The radiographer should ask the patient if she is breastfeeding and notify the nuclear medicine physician or medical physicist should it be the case.
3. On the advice of the physician or medical physicist breastfeeding should be interrupted for the period recommended.
4. The woman could express her breast and store milk, so that it may be given to the child after examination. To ensure milk production, breasts should be expressed and the milk discarded for the time that radioactivity is present.
5. According to the radiopharmaceutical in question (Table 2) the following is recommended.
 - i. **Interruption not essential.** The mother can be reassured by advising a short interruption of 4 hours, after which the milk is expressed and discarded. However, exclude the presence of any other chemical forms of activity.
 - ii. **Interruption for a period of less than 12 hours.** The presence of any other chemicals forms of activity must be excluded.
 - iii. **Interruption for a period of less than 24 hours,** with measurements of excretion of activity in the milk to ensure an EDE (effective dose equivalent) to the infant of less than 1 mSv.
 - iv. **Cessation of breastfeeding** seeing that the recommended period of interruption is very long.
6. Irrespective of whether the woman is breastfeeding, **close contact with the baby should be restricted to 5 hours in a period of 24 hours.**

Table 1: Recommendation regarding breastfeeding mothers		
Radiopharmaceutical	EDE to the infant (mSv/MBq)	Recommendation
⁹⁹ Tc O ⁴	0.092	i
⁹⁹ Tc ^m -MAA	0.015	ii
⁹⁹ Tc ^m -erythrocytes	0.003	iii
⁹⁹ Tc ^m -DTPA	4.25 x 10 ⁻⁵	i
⁹⁹ Tc ^m -DMSA	8.4 x 10 ⁻⁵	i
⁹⁹ Tc ^m -glucoheptonate	1.5 x 10 ⁻⁴	i
⁹⁹ Tc ^m -MDP	1.0 x 10 ⁻⁴	i
⁹⁹ Tc ^m -HDP	5.9 x 10 ⁻⁵	i
⁹⁹ Tc ^m -HMDP	5.3 x 10 ⁻⁵	i
¹²³ I-iodide	0.06	iii
¹²³ I-OIH	0.09	iii
¹²⁵ I-OIH	4.2	iii
¹²⁵ I-fibrinogen	26	iv
¹²⁵ I-HSA	35	iv
¹³¹ I-iodide	113	iv
¹³¹ I-OIH	12	iii
⁶⁷ Ga-citrate	0.5	iv
¹¹¹ In-leucocytes	0.026	i

⁵¹ Cr-EDTA	3.6 x 10 ⁻⁴	i
-----------------------	------------------------	----------

Table 2: Recommended activities for authorizing a patient's release

Radionuclide	COLUMN 1	
	Activity at or below which patients may be released	
	(GBq)	(mCi)
Ag-111	19	520
Au-198	3.5	93
Cr-51	4.8	130
Cu-64	8.4	230
Cu-67	14	390
Ga-67	8.7	240
I-123	6.0	160
I-125	0.25	7
I-125 implant	0.3	9
I-131	0,925	25
In-111	2.4	64
Ir-192	0.074	2
Pd-103 implant	1.5	40
Re-186	29	790
Sc-47	11	310
Se-75	0.089	2
Sm-153	26	700
Sn-117m	1.1	29
Tc-99m	28	760
Tl-201	16	430
Yb-169	0.37	10

RADIOTHERAPY : Handling of UNSEALED radionuclides

I-131 (MIBG)

The necessary dose as prescribed by the specialist doctor (radiotherapist) is ordered by the medical physicists. On arrival of the iodine, it is administered immediately by the doctor in the presence of the physicists. The patient is then isolated and monitored by the physicists until radiation levels are lower than 6 $\mu\text{Sv/hr}$ (2.5 mR/hr) at a distance of 1 meter from the patient.

P-32

Ordering:

The activity needed is specified by the doctor and written on a prescribed form together with the proposed date of administration. The form is handed in at Isotopes and the medical physicist orders the activity. The physicist fills the ordering date and proposed administration date when completing the form.

Administration:

The medical physicist calculates the correct volume of activity which has to be administered and draws the activity into a syringe using the aseptic method. The syringe is placed in a lead container. The medical physicist must be present when the doctor administers the activity, to ensure that no contamination occurs.

RADIOTHERAPY : Handling of SEALED radionuclides

Ir-192

Ordering of activity

The activity of the wire is specified in MBq (mCi) per mm length. Preliminary planning of the area of irradiation must be completed before the activity may be ordered. From this the activity needed is calculated.

Planning

Implantation planning is carried out on a planning system. A preliminary plan is generated to simulate the expected implantation. When the actual implantation is placed within the patient, a final plan is generated with the assistance of simulator films. From the plans the source's residence times in the patient, are calculated.

Patient care

When patients are transported from the theatre to the ward, a radiation warning sign must be attached to the bed. Patients must be isolated during treatment and radiation warning signs placed on the door of the room. Admission to the room must be limited to authorised personnel.

Disposal of activity

Unused radioactive wire, or used wire from the patient, must be labelled clearly and stored until activity has decayed sufficiently. It must be disposed of in accordance with the regulations of the Directorate for Radiation Control.

Au-198 - Gold seeds

Firstly the radiotherapist explains the planned treatment to the physicist. Thereafter a preliminary distribution is calculated simulating an idealised implant on the planning system. It is from this plan that the needed total activity is decided and then ordered.

On receipt the activity is stored in the radium vault. At the appointed time the physicist accompanies the radiotherapist to the theatre where implantation takes place. Monitoring equipment has to be taken to the theatre to monitor personnel during the procedure, as well as to make certain no activity is left in the theatre.

Gold seeds are used for permanent implantations. After implantation, patients are isolated until the exposure rate at 1m has decreased to $6 \mu\text{Sv/hr}$ (2.5 mR/hr).

Sr-90 - Eye applicators

The eye applicator is kept in a lead container at the oncotherapy clinic. A reference table with applications times for required dose is attached to the applicator. The radiotherapists prescribe the dose and the duration of the application is obtained from the table.

Annexure - B (Form for the release of a patient from isolation)

Department Medical Physics : GaRankuwa Hospital

IODINE-131 THERAPY ADMINISTRATION

Patient's Name :

Hospital Number : in ward.....

Patient receivedMBq (..... mCi) radioactive Iodine-131

On Date:

Responsible Medical Physicist

Dept Medical Physics: Monitoring patient's radiation level

Radiation monitor's reading at 1 m (mR/h or μ Sv/h)			
Date	From Patient	From Linen	Signature

Exposure reading at 1 m from the patient is below 6 μ Sv/h(or 2.5 mR/h)

on this day (date)

This patient may now be removed from isolation._____
Print your name

Responsible Medical Physicist